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SAFETY ANALYSIS REPORT, VOLUME 8: CREW
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SHUTTLE ORBITER OV-102 CDR
SAFETY ANALYSIS REPORT
VOLUME VIII
CREW STATION SYSTEMS

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ABSTRACT

Hazard Analyses are presented for each subsystem of the Shuttle Orbiter OV-102 configuration, and include: subsystem descriptions, safety features and hazard analysis printout tabs. This report, "Shuttle Orbiter OV-102 CDR Safety Analysis Report," is prepared per IRD SA-045T in support of OV-102 CDR, updated to April 29, 1977, and consists of the following volumes:

SD77-SH-0001-001, Volume I Management Summary
SD77-SH-0001-002, Volume II Structural Systems
SD77-SH-0001-003, Volume III Mechanical Systems
SD77-SH-0001-004, Volume IV Propulsion Systems
SD77-SH-0001-005, Volume V Power Systems
SD77-SH-0001-006, Volume VI Avionics
SD77-SH-0001-007, Volume VII Environment Control & Life Support
SD77-SH-0001-008, Volume VIII Crew Station & Equipment

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INTRODUCTION

This Safety Analysis Report (SAR) supports the OV-102 CDR. Related SAR's in the Shuttle Orbiter program series include:

SD74-SH-0004	Shuttle Orbiter No. 1 HFT SAR
SD74-SH-0168	Shuttle Orbiter 101 Delta PDR SAR
SD74-SH-0323	Shuttle Orbiter 102 PDR SAR
SD75-SH-0064	Shuttle System PDR SAR
SD75-SH-0135	Shuttle Orbiter 101 CDR SAR
SD76-SH-0038	Shuttle Orbiter 102 Delta PDR SAR

HAZARD ANALYSIS PROCESS

The Hazard Analysis was performed per Rockwell International-Space Division, Reliability and Safety Desk Instruction 400-1. The hazard analysis process, shown in Figure 1, involves the evaluation of the Orbiter in its mission phases by subsystem identified by the System Definition Manual number for hazards in the major hazard groups described in the desk instruction and coded as listed below:

Illness/Injury/Loss of Personnel	AA
Collision/Impact/Erosion	BB
Fire/Explosion/Implosion	CC
Loss of/Unsafe Environment	DD
Crash Landing/Ditching	EE
Loss of Flight Control	FF
Other (Not Defined)	XX

The status classifications presented in the summary are defined in the desk instruction and listed below:

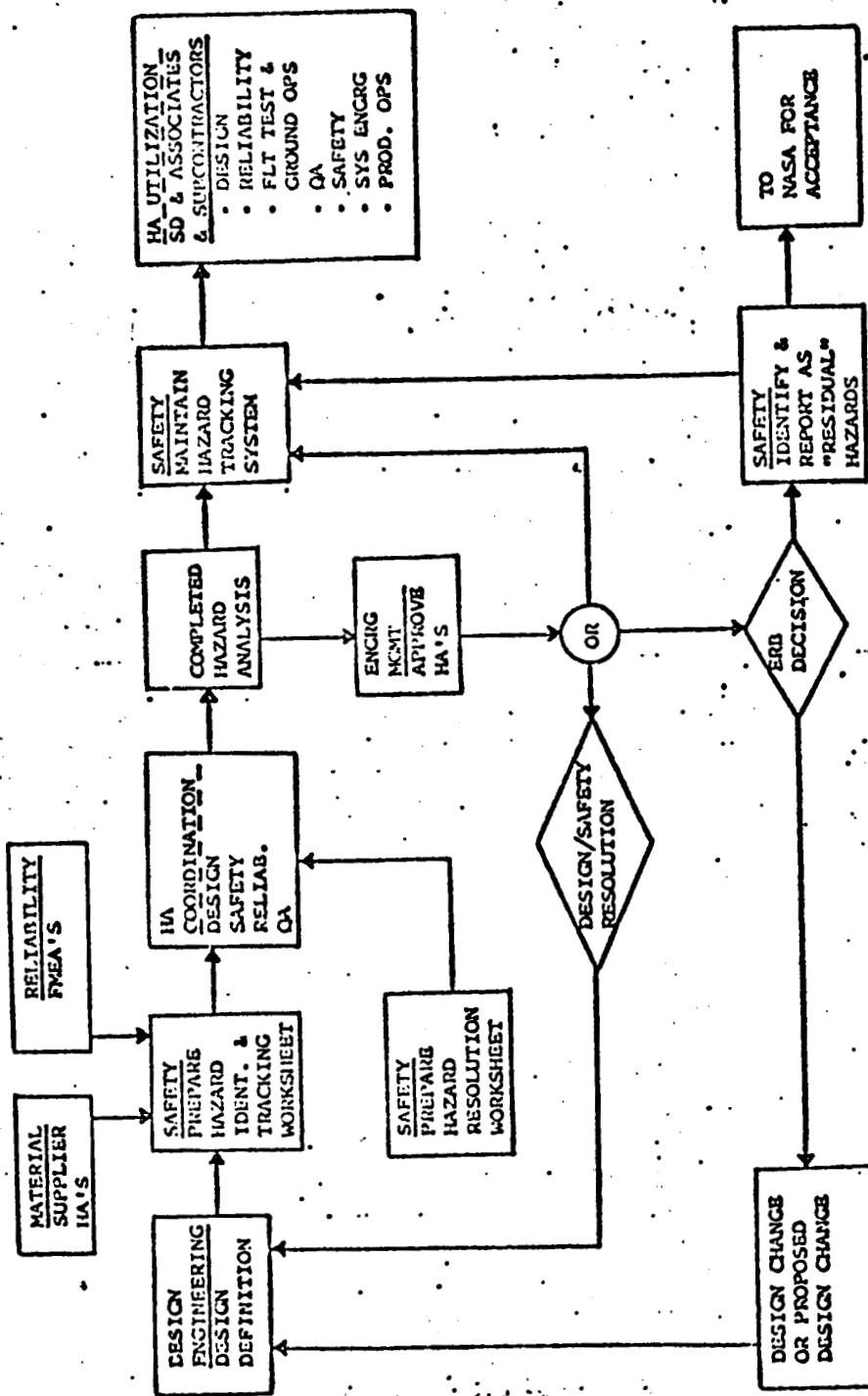
Open (In-Work)	Closed (Eliminated)
Open (Residual)	Closed (Controlled)
	Closed (Accepted)

HAZARD ANALYSIS GROUND RULES

Ground rules used for the hazard analysis are as follows:

1. Hazards are identified per the rationale stated in Desk Instruction 400-1 and NHB 5300.4 (1D-1).
2. Hazard analyses are conducted according to Desk Instruction 400-1 and NHB 5300.4 (1D-1).
3. Hazard levels are as stated in NHB 5300.4 (1D-1).
4. All Criticality 1 FMEA's are analyzed for hazards.
5. All other FMEA's are reviewed for identification of potential hazards.
6. Hazards requiring three or more failures will not be considered.
7. Unless stated in the hazard analysis, equipment is presumed to be operating per specification.

FIGURE 1 - HAZARD ANALYSIS PROCESS



SD77-SII-0001-08

ORGANIZATION OF THE REPORT

The first section of the report is a description of the individual subsystems. These are very brief descriptions and they are intended to provide sufficient technical information so that the subsequent safety data and discussions are understandable to the reader who may not be familiar with the particular system.

The second section discusses safety features which are in the particular system. A discussion of the safeguards in the system is necessary to indicate the rationale of why particular potential hazards were not documented in the hazard analysis section. An additional feature of this section is to provide some general information on the Generic Hazard Groups derived from NHB 5300.4 for the specific subsystems. This data should be useful in terms of providing additional visibility and rationale involved in the hazard analysis selection process.

The third section is a summary of the individual hazard analyses. A discussion is given to the open, i.e., in-work or residual hazards which have not been closed out as of the date of this report. The current status and resolution plans for these open potential hazards is also briefly discussed. Three tables are also included in this summary section. Table I lists the number of HA's which have been generated for the individual hazard groups (Fire, Collision, etc.) for each of the subsystems. Table II is a tabulation of all the HA's in the particular volume. This list includes an identification number so that the reader can locate a particular potential hazard in the HA section of the document. This list also provides a descriptive title and current status for the individual potential hazards. It should be noted that a Catastrophic hazard is one in which no time exists to correct the problem, whereas in a Critical hazard situation time for corrective action is available. Table III is a Mission Phase Listing of the HA's.

The last section of the report contains the individual HA's which are arranged alpha-numerically by the identification numbers previously mentioned. This kind of listing results in the HA's being grouped by subsystem. Subsystem identifiers are also included on the top of the sheets to assist in locating specific items.

SUBSYSTEM DESCRIPTIONS

CREW MOBILITY AIDS/DEVICES

Crew mobility aids/devices will be provided within the crew compartment and the payload bay to facilitate efficient and safe movement of personnel under normal and emergency conditions. These aids/devices will be designed as required for usage: under 1G horizontal and vertical static conditions; during horizontal flights; and during orbital flights. They will consist of handholds, rails, foot restraints, and tether or lifeline attach points.

EMERGENCY EGRESS DEVICES

Emergency egress devices are intended to aid flight personnel in rapidly and safely egressing from the vehicle to the ground under static vehicle conditions. These static conditions include normal horizontal attitude after landing, and normal or unusual attitudes following a crash landing.

Two egress routes are available to provide unimpeded evacuation under all anticipated conditions. The primary route is via the side hatch and the secondary or alternate route is via the overhead ejection panels.

The side hatch incorporates a swing-out bar that extends outboard from the open hatch upper surface. The bar permits a safe and expedient means for egressing crewmen to translate from the hatch to the ground. The bar is grasped from a sitting position on the hatch, the body is then shifted to a hanging position on the bar and the final step is to drop the remaining short distance to the ground.

Two Sky Genies are provided for overhead egress and are stowed in a container secured to the left hand inboard ejection rail support structure. The end of each Sky Genie rope is attached to the seat rail support structure adjacent to the stowage container.

The Sky Genie is comprised of an aluminum shaft with an eye-bolt attachment at the lower end for securing the man to the unit. Two to four turns of a 3/8" diameter nylon descent rope is wound around the shaft to control the rate of descent through normal rope-to-shaft friction. The shaft is enclosed with a 1-3/4" diameter housing to maintain the proper rope wrap around the shaft. The unit effectively slides down the rope at a maximum rate of descent determined by the number of turns of rope wound around the shaft with respect to the load being lowered and further controlled by tension applied to the free end of line by the descending crewman. The overall dimensions of the unit, excluding the rope, is approximately 1-3/4" diameter by 9" long.

A thermal blanket will be utilized following re-entry for protecting the egressing crewman from contact with heated TPS during overhead egress. The blanket will be deployed through the overhead panel openings. A thermal skirt will also be provided on the side hatch cover for primary egress protection.

STOWAGE PROVISIONS

Forty-two (42) modular stowage lockers are provided in the mid-deck area to accommodate a variety of stowage needs. The external dimensions of each locker are 21.062 x 18.125 w x 10.750 h; the empty weight is approximately 10 pounds. They are mounted to the avionics wire trays by four #10 captive sleeve bolts. Positioning for mounting is facilitated by guide pins (2 per box) located on the wire trays. A 23-inch tool is required to reach the sleeve bolts for engagement and tightening to a final torque of 30 inch-pounds.

Thirty-three (33) lockers can be mounted to avionics bays I and II and the remainder to avionics bay III. The lockers are designed to be removable on-orbit. Access to locker contents is through the front face door which is hinged along the bottom edge and secured in a closed position by two (2) finger-tightened captive bolts located in the upper two corners of the door during launch and entry. On orbit, the door is retained by a magnetic latch.

EQUIPMENT MOUNTING PROVISIONS/BRACKETRY

Mounting provisions are provided for both CFE and GFE equipment. Mounting may require adapter bracketry between equipment and the vehicle structure or in some cases the equipment will be attached directly to the crew module structure.

EMERGENCY EQUIPMENT

All emergency equipment, excluding the escape system which is described in the following section, is provided as GFE. This includes such items as the Portable Oxygen System (POS), survival kits, and medical kits.

Note: hand held fire extinguishers are described as part of the ECLSS System.

ESCAPE SYSTEM

The escape system is comprised of two basic subsystems that are inter-related. They can be described as: ground emergency egress and ejection seat escape subsystem.

Ground emergency egress provides two avenues of escape. The primary route is via the side crew hatch and the secondary is via the overhead ejection panels. Both the side hatch and panels can be opened from the inside by the crew for immediate egress or from the outside by the ground crew for aided egress.

The ejection seat escape subsystem consists of two Lockheed Model F-12 ejection seat units that interface with the orbiter energy transfer system (ETS) for proper sequencing of panel severance/ejection and seat catapult firing initiation. The ETS also provides the capability of only severing and ejecting the panels without firing the seats in the case of ground emergency egress via the panels.

Ground Emergency Egress

Ground emergency capability for OV-102 (OFT) is described under Emergency Egress Devices section.

Ejection Seat System

The F-12 stabilized seat is an open ejection seat design to provide emergency escape from zero altitude through 75,000 feet. The seat has two modes of operation: (1) for ejections above 15,000 feet, the seat descends on a drogue chute to 15,000 feet where separation and main parachute deployment occurs, and (2) for ejections below 15,000 feet, the main chute is deployed 1.6 seconds after the catapult ignition. The seat is stabilized in both modes of operation by means of a 78" drogue chute located in the head rest which is deployed by a mortar as soon as the seat leaves the cockpit. The drogue chute not only stabilizes the seat during the ejection phase but also provides stability for the long descent from high altitude. It also provides rapid, controlled deceleration which allows quick deployment of the main parachute for low altitude ejections. The seat's low altitude capabilities are enhanced by a mortar-deployed main parachute which results in dependable, predictable, and rapid opening characteristics.

This system has the capability of providing safe recovery for ejections under the conditions of zero speed and altitude. The four aspects of the system that primarily provide this capability are: (1) a high impulse rocket that produces maximum ground clearance, (2) a high energy seat separator which provides positive man-seat separation and arms the main parachute on the power stroke, (3) the fast system timing, and (4) the mortar-deployed quick-opening parachute.

An integral part of the system is the emergency life support equipment. This includes emergency oxygen for suit pressurization and breathing when an ejection occurs at high altitude. The emergency oxygen along with land and/or water survival gear is located in the survival kit and seat cushion. An inflatable life vest is an integral part of the pressure suit.

GROUND SAFING DEVICES

Each man/machine interface or mechanically actuated initiation device in the escape system will be provided with a device which, when installed, will positively lock the actuation mechanism so that inadvertent actuation is prevented. Controls and devices

which will be included in this safing procedure include ejection initiating controls on each seat, internal and external panel jettison initiating controls, and mechanical devices on the seat or seat guidance structure whose inadvertent initiation would endanger personnel or degrade the performance of the escape system. Each ground safety device will have a flag attached to it. Flag attachments to the safety device will make it impossible to remove the device by pulling or stepping on the flag.

SAFETY FEATURES

GENERAL

This section presents the results of the hazard analysis performed on the Crew Station and Equipment. The hazard groups identified in Desk Instruction 400-1 were complied with to arrange the material in this section of the Safety Analysis Report. Each paragraph identifies the hazard group and the subparagraph depict the potential hazard along with the corrective measures in which design or operation will eliminate or control the potential hazard.

MOBILITY AIDS/DEVICES

Injury or Loss of Personnel

Structural failures and improper design or location of devices could result in injuries during usage or inadvertent contact with the device during one-G and zero-G crew movement activities. Crew station mockup testings and evaluations have been used effectively to control the proper location, configuration and functional provisions of aids/devices to assure acceptable man-machine interface compatibility and function.

EMERGENCY EGRESS DEVICES

Injury or Loss of Personnel

Emergency egress devices (Sky Genies) have been identified for OV-102. Each crewman will be provided with one of these devices. The Sky Genie has been used for a number of years by such organizations as forestry, fire departments, construction industry, and others. It has been approved by the State of California Division of Industrial Safety since 1966. The Sky Genie has been used on the orbiter mockup in Emergency Egress Tests to ascertain its adaptability and safe performance in meeting orbiter emergency egress requirements. Test results have indicated its suitability for safe performance of the intended task. Suitable locations for the attachment of the devices were also substantiated by these tests.

EQUIPMENT MOUNTING

Collision/Impact

Equipment mounting involves the following basic safety considerations:

Strength of mounting and equipment securement to insure that equipment does not release prematurely under worse case condition of crash loading.

Equipment and its mounting or bracketry does not present an interference or collision hazard to crewman or ground personnel during routine or emergency activities within the crew module.

Equipment is located, designed or guarded in a manner that precludes its use as a convenient handhold-foothold unless it is capable of withstanding such usage without degradation.

These safety considerations are being used by Design Engineering as criteria to insure safe and acceptable installations.

EMERGENCY EQUIPMENT

In general, all emergency equipment is provided as GFE and is not considered within the scope of this report.

However, the capability for timely retrieval of these items during unpredicted emergency occurrences is of prime concern. Consequently, studies have been conducted to insure that suitable mounting/stowage locations will adequately provide this usage capability.

ESCAPE SUBSYSTEM

Injury, Loss of Personnel

Failure of Ejection Panel to Clear Vehicle - The listed causes relate to mechanical failure of the ejection panel assembly components. The design has been based on appropriate load analysis and specification design factors have been applied which provide adequate margins of safety which insure non-failure of components. The system will be further sled tested to verify functional integrity.

Ejected Panel Strike Ground Personnel - This hazard has been classified as residual due to the unpredictability of ejection occurrence. However, this hazard can be minimized by pre-planning including flight path programming to avoid populated areas and ground rescue procedural cautions with respect to ejected contacts.

Ejection Seat Malfunction - The Lockheed Model F-12 ejection seat is a fully qualified system and has been operational for some time. The reliability of the seat system in performing within the conditions imposed by Shuttle performance and requirements have been verified by analysis and will be further confirmed by sled tests.

Ejection Panel Controls Inaccessible - Safety was concerned with the ability of a low percentile individual to reach and activate the panel jettison control from a seated position for the purpose of initiating panel jettison for a secondary egress option. The adequacy of design was substantiated by mockup tests which verified that this function could be achieved by all individuals within the 5 - 95 percentile range.

Capability to Safely Perform Emergency Egress Within the 60 Second VEI Specification Requirement - Extensive ground egress testing was performed on the orbiter mockup. The tests evaluated various proposed avenues of egress and egress devices. The current baseline egress routes and egress devices were proven safe and acceptable for their intended usage.

Premature Chute Deployment at Altitudes Above 15,000 Feet - This hazard was based on the assumption that the ejection seat aneroids that initiate main chute deployment may not be compatible with the constant one atmosphere of pressure normally maintained within the crew module. Upon ejections at altitudes above 15,000 feet, the aneroids which had been subjected to zero altitude pressures (14.7 psi) within the crew module, may not have been sufficiently responsive to the new ambient pressure to inhibit chute deployment until the safe 15,000 foot altitude had been reached. Special tests performed by Universal Propulsion Company proved that together with a series time delay contained in the basic seat circuit, the aneroids would respond to pressure changes within sufficient time to provide a substantial margin of safety.

Collision/Impact

Collision of Ejection Seats - This hazard has been reduced by design changes which incorporate a 0.5 second time delay between seat ejections, and modification to the ejection seat rails to provide increased divergence between seat paths.

GROUND SAFETY DEVICES

Loss of Personnel

Accidental Actuation of Escape System During Ground Operations - This hazard has been controlled by the use of safety controls and devices as described previously. The hazard has been closed on the basis of these safety provisions.

CREW STATION AND EQUIPMENT SYSTEM HAZARD SUMMARY

This volume of the Safety Analysis Report addresses the OV-102 Shuttle Orbiter, Vertical Flight Configuration, Crew Station and Equipment (CS&E) System. Twenty HA's have been identified in the CS&E area. The hazard analysis was performed in parallel with design definition and many of these hazards were identified from information in reports such as the Accident/Incident Data Bank and the JSC 00134 Space Flight Hazard Catalog that was available from previous programs. In most cases the initial design incorporated the safety features to eliminate or control these hazards, and the Safety Analysis Report listing was used as a method to check that the safety features were incorporated in the design. Table I is a summary of the number of hazards in each hazard category for each CS&E group. Table II lists each of the hazards identified, by CS&E subsystem, and their disposition. Table III is a mission phase breakdown of the HA's. Of the twenty hazards identified, thirteen of these are closed and seven are open, five of which are in an in-work status and two are residual hazards.

RESIDUAL HAZARDS

1YXX-0712-1A "Insecurity of Stowage Container Mounting." This hazard has been classified as a residual hazard due to the lack of visual capability to verify that all containers are properly secured to their mountings. Prior to a mission, stowage containers will be installed and while on-orbit they may be temporarily removed and then reinstalled prior to reentry. The installation of containers involves securement of the container to its mount by use of blind fasteners. Therefore, a final visual check cannot be made to insure that all fasteners have been engaged and properly tightened.

1VXX-0721-2A "Ejected Panel Strikes Ground Personnel and/or Property." This hazard has been classified as a residual hazard due to the unpredictability of ejection occurrence. However, this hazard can be minimized by pre-planning including flight path programming to avoid populated areas and ground rescue procedural cautions with respect to ejected panel contacts.

OPEN HAZARDS - IN WORK

1YXX-0710-03 "Emergency Egress Device Failure." This hazard was originally identified as an OV-101 and subs concern (H/A 1ZXX-0710-1C). Due to OV-102 and subs design differences inside hatch egress provisions - increased number of Sky Genies required for flight deck egress, and hot TPS contact with Sky Genie descent lines - this concern has been reidentified by this new HA effective OV-102 and subs, and is still in work.

1ZXX-0716-1B "Damage to ETS Lines Because of Inadequate Protection." This hazard has been reopened (1-19-76) for the purpose of identifying an additional hazard cause relating to potential damage of energy transfer system (ETS) lines. ETS lines are susceptible to damage from bending and impact as a result of exposure to kicking, snagging or handhold usage. This damage is not visually detectable and can render the crew escape system inoperative. It is therefore important that these lines be shielded or guarded from abuse. Closeout panels have been provided for OV101 and design is in progress to satisfy this required protection for OV102 (Ref. MCR 2497).

ORIGINAL PAGE IS
OF POOR QUALITY

IVXX-0717-06 "POS Inaccessibility." This is a new HA that is concerned with providing on station usage capability during all critical mission phases. Design is investigating possible mounting locations that will permit immediate in-place usage during an emergency.

IVXX-0721-13 "Flying Objects Caused by Decompression Effect from Panel Jettison During High Altitude Ejections." This hazard relates to possible direct injury to crewmen or interference with the safe functioning of the ejection seat system. Action to resolve this problem is currently in progress under authorization by MCR 3164.

IVXX-0721-14 "Ejection Seat Aneroid Damage from Crew Compartment Pressure Tests (MCR 1983)." The aneroids, which control main chute deployment, are not presently qualified for exposure to overpressures. Overpressure damage to the aneroids could result in malfunction of main chute deployment. Testing is in progress to insure that the aneroids will not be adversely affected by anticipated crew compartment pressure testing.

HAZARD GROUP APPLICATION MATRIX

Crew Station and Equipment

Hazard Group	Code	Mobility Aids & Devices	Emerg. Egress Devices	Stowage	Equip. Mount.	Emerg. Equip.	Escape System	Escape System Safing
Loss of Personnel	AA	1	N/A	N/A	N/A	N/A	9	1
Collision/Impact	BB	N/A	1	1	1	N/A	5	N/A
Loss of/Unsafe Environment	DD	N/A	N/A	N/A	N/A	1	N/A	N/A

N/A = Not Applicable

TABLE I

TABLE II
HAZARD ANALYSIS SUMMARY

MODEL		SHUTTLE ORBITER OV-102 CDR		STATUS	
SUBSYSTEM GROUP		CREW STATION & EQUIPMENT		OPEN	CLOSED
HAZARD NUMBER	HAZARD GROUP	PROBLEM DESCRIPTION		IN-WORK	RESIDUAL
<u>MOBILITY AIDS & DEVICES</u>					
TZXX-0708-1C	AA	Failure of Device			X
<u>EMERGENCY EGRESS DEVICES</u>					
TYXX-0710-03	BB	Failure of Device		X	
<u>STOWAGE</u>					
TYXX-0712-1A	BB	Failure of Mountings		X	X
<u>EQUIPMENT MOUNTING</u>					
TZXX-0716-1B	BB	Failure of Mount, Att, Etc.		X	
<u>EMERGENCY EQUIP.</u>					
TYXX-0717-06	DD	Pos. Inaccessibility		X	
<u>ESCAPE SYSTEM</u>					
TVXX-0721-1C	AA	Ejection Panel Failure			X
TVXX-0721-2A	AA	Eject. Panel Strikes Personnel		X	X
TVXX-0721-3B	AA	Ejection Seat Failure			X
TYXX-0721-4B	AA	Premature Ejection			X
TVXX-0721-5A	BB	Ejection Seats Collide			X
TVXX-0721-6B	BB	Ejection Seat Rail Failure			X
TVXX-0721-7A	BB	Rail Fail. During Crash Landing			X
TVXX-0721-8A	AA	Ejection Panel Control Accessibility			X
TVXX-0721-9C	AA	Inability of 60 Sec. Emerg. Egress			X
TVXX-0721-10A	BB	Seat-To-Ejec. Panel Collision			X
TVXX-0721-11	AA	Premature Chute Deployment			X
TYXX-0721-12C	AA	Back Wedge Retract Failure			X
TVXX-0721-13	BB	Flying Objects During Eject.			X
TVXX-0721-14	AA	Main Chute Deployment Failure		X	
<u>ESCAPE SYSTEM SAFING</u>					
TVXX-0722-1A	AA	Accidental Seat Ejection			X

TABLE III
HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: CREW STATION & EQUIPMENT

HAZARD NUMBER	PROBLEM DESCRIPTION
<u>PRELAUNCH</u>	
1ZXX-0708-1C	Failure of Device
1ZXX-0716-1B	Failure of Mount, Att, Etc.
1YXX-0717-06	Pos. Inaccessibility
1VXX-0721-9C	Inability of 60 Sec. Emerg. Egress
1VXX-0721-14	Main Chute Deployment Failure
1VXX-0722-1A	Accidental Seat Ejection
<u>LIFT OFF THRU ORBIT</u>	
1YXX-0712-1A	Failure of Mountings
1ZXX-0716-1B	Failure of Mount, Att, Etc.
1YXX-0717-06	Pos. Inaccessibility
1VXX-0721-1C	Ejection Panel Failure
1VXX-0721-2A	Eject. Panel Strikes Personnel
1VXX-0721-8B	Ejection Seat Failure
1VXX-0721-5A	Ejection Seat Collision
1VXX-0721-6B	Eject. Seat Rail Failure
1VXX-0721-10A	Seat/Ejection Panel Collision
1VXX-0721-11	Premature Chute Deployment
1YXX-0721-12C	Back Wedge Retract Failure
1VXX-0721-13	Flying Objects During Ejection
1VXX-0721-14	Main Chute Deployment Failure
<u>ON ORBIT</u>	
1ZXX-0708-1C	Failure of Device
1YXX-0712-1A	Failure of Mountings
1ZXX-0716-1B	Failure of Mount, Att, Etc.
1YXX-0717-06	Pos. Inaccessibility
1YXX-0721-4B	Premature Ejection
<u>DE-ORBIT THRU LANDING</u>	
1YXX-0710-03	Failure of Device
1YXX-0712-1A	Failure of Mountings
1ZXX-0716-1B	Failure of Mount, Att, Etc.
1YXX-0717-06	Pos. Inaccessibility
1VXX-0721-1C	Ejection Panel Failure
1VXX-0721-2A	Eject. Panel Strikes Personnel

(continued)

TABLE III
HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: CREW STATION & EQUIPMENT

HAZARD NUMBER	PROBLEM DESCRIPTION
<u>DE-ORBIT THRU LANDING (Cont.)</u>	
1VXX-0721-3B	Ejection Seat Failure
1VXX-0721-5A	Ejection Seat Collision
1VXX-0721-6B	Ejection Seat Rail Failure
1VXX-0721-7A	Rail Fail. During Crash Landing
1VXX-0721-8A	Eject. Panel Control Accessibility
1VXX-0721-9C	Inability of 60 Sec. Emerg. Egress
1VXX-0721-10A	Seat/Eject. Panel Collision
1VXX-0721-11	Premature Chute Deployment
1YXX-0721-12C	Back Wedge Retract Failure
1VXX-0721-13	Flying Objects During Eject.
1VXX-0721-14	Main Chute Deployment Failure

HAZARD ANALYSIS LISTING

The tabular listing of hazard analyses are included. The initial and tracking level listings are as follows:

- CA Catastrophic: no time available to accommodate potential hazard.
- CR Critical: time available to react to potentially hazardous situation.
- CA/CN Catastrophic potential hazard having methodology identified to control hazard..
- CR/CN Critical potential hazard having methodology identified to control hazard.
- CN/CN Potential hazard that has been controlled or eliminated.

Note: CA or CR tracking status indicates an open hazard. CA/CN or CR/CN indicates a conditionally control hazard and CN/CN is a closed hazard.

APPENDIX A

Crew Station Systems Hazard Analysis Printout

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT OR OPERATION	LEVEL	H2D INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
12XX-0108-1C MOBILITY AID-DEVICES	CA	CN/CN 1	CCNTROLLED	041774

HAZARD DESCRIPTION

INJURY OR LOSS OF PERSONNEL DUE TO CREW MOBILITY AIDS OR DEVICES FAILURE.

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT CN ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP AA INJURY OR LCSS OF PERSONNEL RESP.ENGR. I.J.ALONGI

RELATED FMEAS	FMEA RECD YES NO
NONE	X

REFERENCES

SUM 21-0, RRD SD72-SH-0107

HAZARD CAUSES

UI-STRUCTURAL FAILURE OF AIDS-DEVICES ATTACHMENTS

HAZARD EFFECTS

PHYSICAL INJURY RESULTING FROM FAILURE OF AIDS-DEVICES DURING
CREW MOVEMENT OR OPERATIONS.

RELATED HAZARD ANALYSES

NONE

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HA-TRACK

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HAZARD NUMBER 12XX-C108-1C

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD C.BROWN

DISPOSITION

01-CJ MPLY WITH LCAD REQUIREMENTS

OF MSC SC-E-0006

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON REQUIREMENTS CONTAINED IN
CERTIFICATION PLAN SD77-SH-0041-2 AND IMPLEMENTATION
OF CORRECTIVE ACTION NOTED ABOVE.

HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT
NUMBER OR OPERATION INIT TRACK CAT STATUS DATE

LYXX-U10-03 EMERG EGRESS DEVICE CA CA/CN 001 IN WORK 051376

HAZARD DESCRIPTION

EMERGENCY EGRESS DEVICE FAILURE

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP BB COLLISION/IMPACT

RESP.ENGR. I.J.ALONGI

FMEA REQD YES NO

X

RELATED FMEAS

U1-2-125102-1

REFERENCES

SDM 21.0, RDD SD72-SH-0107, MCR 3165

HAZARD CAUSES

- 01-SIDE HATCH EGRESS DEVICE FAILS TO PROVIDE ADEQUATE GRIP
- 02-SECUREMENT DUE TO LOCATION AND/OR CONFIGURATION
- 03-FLIGHT DECK EGRESS DEVICES FAIL DUE TO ENTANGLEMENT WITH EACH OTHER
- 04-FLIGHT DECK EGRESS DEVICES FAIL DUE TO CONTACT OF DESCENT LINES WITH HOT TPS SURFACES
- 05-FLIGHT DECK EGRESS DEVICES NOT PROPERLY LOCATED FOR IMMEDIATE USAGE

SD77-SII-0001-08

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER 0710-03

HAZARD EFFECTS

INJURY OR LOSS OF PERSONNEL DUE TO DELAYED EGRESS, DESCENT HANG
UP OR FALLS

RELATED HAZARD ANALYSES

JUNE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD G.E.BAZELL

SAFETY LEAD R.E.RABY

22

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-03 FUNCTIONAL TESTING SHOULD
BE PERFORMED TO VERIFY THE
ADEQUACY OF THE COMPLETE
EMERGENCY EGRESS SYSTEM
397-102

SD77-SII-0001-08

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2D INIT TRACK	HAZARD CAT STATUS	ENTRY DATE
LYX-U712-1A	STOWAGE PROVISIONS	CA CA	RESIDUAL	070974

HAZARD DESCRIPTION

FAILURE OF STOWAGE CONTAINERS TO REMAIN SECURED TO THEIR MOUNTING SUR RELEASE OF THEIR CONTENTS TO THE CABIN ENVIRONMENT CREATING A POTENTIAL IMPACT HAZARD TO PERSONNEL AND CRITICAL ORBITER SYS

FLIGHT TEST X GROUND TEST FERRY FLIGHTS X ORBITAL MISSION OTHER PKELAJNCH LIFT OFF THRU ORBIT X CN ORBIT X CE-ORBIT THRU LANDING X

HAZARD GROUP BB COLLISION-IMPACT

23

RELATED FMEAS

NONE

REFERENCES

SD72-SH-01C7, MCR 0942, MCR 0419

HAZARD CAUSES

01-IN SUFFICIENT STRUCTURAL STRENGTH TO WITHSTAND CRASH LOADS
 02-CONTAINERS NOT PROPERLY SECURED TO SUPPORT STRUCTURE DURING LAUNCH, ENTRY OR ORBITAL DELTA-V MANEUVERS
 03-CONTAINER DOORS OR COVERS NOT SECURE DURING LAUNCH, ENTRY OR ORBITAL DELTA-V MANEUVERS

HAZARD EFFECTS

INJURY OR LOSS OF PERSONNEL BY CONTACT WITH UNSECURED CONTAINERS OR THEIR CONTENTS DURING NORMAL ACCELERATION-DECELERATION FLIGHT MOUES OR CRASH LANDINGS. DAMAGE TO ORBITER SYSTEMS FROM PRECEDING CAUSES RESULTING IN LOSS OF VEHICLE AND PERSONNEL

SD77-SH-0001-08

HAZARD NUMBER 1YXX-0712-1A

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD T.W.STANIEC

SAFETY LEAD R.E.RABY

DISPOSITION

U1-COMPLY WITH CRASH LOAD REQUIREMENTS PER MJ C70-0001
 U2-DESIGN CONTAINER TO STRUCTURE FASTENER SYSTEM TO PROVIDE A CONSPICUOUS VISUAL INDICATION THAT THE FASTENERS ARE FULLY ENGAGED FOR PROPER SECUREMENT OF CONTAINER

Q3 PROVIDE A CONSPICUOUS VISUAL INDICATION THAT FASTENERS ARE FULLY ENGAGED FOR PROPER SECURE MENT OF DOORS AND COVERS

CLOSURE RATIONALE

SD77-SH-0001-08

RESP GRP

397-102
 VERIFICATION PER
 SD74-SH-0041-2

397-102
 COLOR MARKINGS WILL
 INDICATE LOCK/UN-
 LOCK CONDITION SPS
 DWG NS202099

397-102
 COLOR MARKINGS WILL
 INDICATE LOCK/UN-
 LOCK CONDITION SPS
 DWG NS202099

HAZARD ITEMS Q1- AND Q3- ARE CLOSED BASED ON IMPLEMENTATION OF CORRECTIVE ACTION ITEMS Q1- AND Q3- ABCVE.
 HAZARD ITEM Q2- IS RESIDUAL DUE TO IMPRACTICABILITY OF PHYSICALLY CHECKING ALL CONTAINERS FOR SECURENESS DURING CERTAIN PHASES OF THE MISSION. THIS TYPE OF INSTALLATION PRECLUDES CAPABILITY FOR VISUAL VERIFICATION OF FASTENER SECURITY. VERIFICATION CAN BE MADE ONLY BY INSERTION OF A SPECIAL INSTL/ REMOVAL TOOL WHICH IS THEN ROTATED TO CHECK PROPER TORQUE AND ENGAGEMENT OF FASTENERS. STRICT ADHERENCE TO THE PRACTICE OF IMMEDIATELY SECURING THE CONTAINER WHEN IT IS RETURNED TO ITS PROPER STOWAGE LOCATION MAY MINIMIZE THE HAZARD OF INSECURE CONTAINERS

HA-TRACK

01/27/77 PAGE 3

HAZARD NUMBER 1YXX-C712-1A

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	CATE
G.E.BAZELL	397-102	061775	F.J.ATTAWAY	061775

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT
NUMBER OR OPERATION

17X-0716-1B EQUIPMENT MOUNTING

HAZARD DESCRIPTION

DAMAGE TO PERSONNEL AND/OR EQUIPMENT FROM EQUIP THAT RELEASES
FROM ITS STOWABLE OR USE MOUNTING, OR FROM PERSONNEL IMPACTING
EQUIP WHILE STILL RETAINED IN ITS MOUNTING

FLIGHT TEST X GROUND TEST FERRY FLIGHTS CRBIT MISSION X CTHR
PRELAUNCH X LIFT OFF THRU ORBIT X GN CRBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP BB COLLISION-IMPACT

RESP.ENGR. I.J.ALCNGI

FMEA REQD YES NO

X

26

RELATED FMEAS

NONE

REFERENCES

SD-72-SH-01C7, MCR 2497

HAZARD CAUSES

- 01-RELEASE OR HOLDING DEVICE, BRACKETRY, OR SUPPORTING STRUCTURE
- 02-FAILS UNDER CRASH LOADING.
- 03-MOUNTING IS DAMAGED OR WEAKENED BY BEING SUBJECTED TO ABNORMAL HANDHOLD USAGE
- 04-MOUNTING LOCATION CREATES AN INTERFERENCE HAZARD WITH NORMAL AND EMERGENCY MOBILITY PATTERNS AND PATHWAYS OF CREWMAN
- 05-ENERGY TRANSFER LINES DAMAGE FROM HANDHOLD USAGE OR EXPOSURE TO IMPACT FROM KICKING, SNAGGING, ETC.

SD77-SH-0001-08

HAZARD NUMBER 1ZXX-0716-1B

HAZARD EFFECTS

INJURY TO OR LOSS OF PERSONNEL BY CONTACT WITH LOOSE OR MOUNTED EQUIPMENT. MISSION ABORT AS A RESULT OF EQUIPMENT DAMAGE.

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD T.W.STANIEC

SAFETY LEAD R.E.RABY

DISPOSITION

27

RESP GRP

ACTION DOCUMENTATION

01-DESIGN MOUNTINGS PER CRASH

LUAC REQUIREMENTS OF CEI SPEC

HJC70-COC1

397-102
02-WHERE SIZE, SHAPE AND LOCATIONOF EQUIPMENT MOUNTING ASSY
MAKES IT A CANDIDATE FOR HAND-
HOLD USAGE, IT SHOULD BE DE-
SIGNED TO WITHSTAND HANDHOLD
LOADS PER NASA SPEC SC-E-0006397-102
03-EQUI-LOCATE TO MINIMIZE ACCI-
DENTAL CONTACTS OR PROVIDE
SHIELDING

SD77-SII-0001-08

HA-TRACK

01/27/77 PAGE 1

HAZARD NUMBER	SUBSYSTEM-OPERATION	LEVEL	CATEGORY	STATUS	DATE
1ZX-0117-01	PORTABLE FIRE EXTING	CA	CA/CN 1	DELETED	041874

HAZARD DESCRIPTION

INJURY OR LOSS OF PERSONNEL DUE TO FAILURE OF FIRE EXTINGUISHER
TO OPERATE SAFELY AND EFFECTIVELY (SEE HA NUMBER 1ZX-0602-04-07)

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2D INIT	HAZARD TRACK CAT STATUS	ENTRY DATE
1ZXX-0717-2A	PORTABLE FLOODLIGHTS CA	12	DELETED	041874

HAZARD DESCRIPTION

INJURY OR LOSS OF PERSONNEL DUE TO FAILURE OF FLOODLIGHTS TO

REFERENCES
PRELAUNCH X LIFT OFF THRU ORBIT X GN ORBIT DE-ORBIT THRU LANDING X

NONE
FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER X

OPERATE OR PERFORM EFFECTIVELY

29
RELATED FMEAS

HAZARD GROUP AA INJURY OR LOSS OF PERSONNEL RESP.ENGR. I.J.ALONGI

MCR 156, SDM 21.0, RDD 5072-SH-0107

HAZARD CAUSES

- 01-FAILS TO OPERATE DUE TO COMPONENT FAILURE OR DAMAGE
- 02-INADEQUATE LIGHT OUTPUT
- 03-INPROPER LOCATION

HAZARD EFFECTS

INJURY OR LOSS OF PERSONNEL DUE TO INEFFECTIVE LIGHTING DURING CRITICAL EMERGENCY OPERATIONS REQUIRING VISUAL TASKS PERFORMANCE

S 077 - S II - 0001 - 08

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER LZX-C717-2A

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY
RESP GRP ACTION DOCUMENTATION

DISPOSITION

01-DESIGN AND VERIFY BY TBD
02-COMPLY WITH RQMTS OF
SD 72-SH-0107
03-VERIFY BY DESIGN MUCKUP AND
TEST

397-102
397-102
397-102

CLOSURE RATIONALE

THIS HAZARD DELETED BECAUSE THE REQUIREMENT FOR CFE PORTABLE
FLUOOLIGHTS HAS BEEN DELETED. REFERENCES: ORBITER POR RID
04-JJ-35, ROCKWELL INTERNATIONAL RESPONSE TO RID - 74MA4688,
NASA CONCURRENCE FOR DELETION AS CFE - 5337MA

077-SH-0001-08

CLOSURE DOCUMENTATION

RI/SD FILE NUMBER 5337MA FOR NASA CONCURRENCE LETTER

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE
F.J. ATTAWAY 060575
-INTERFACE

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2O INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
JAXX-0117-3A	SMOKE PROTECT HELMET CA	12	DELETED	041274

HAZARD DESCRIPTION

LOSS OF OR UNSAFE ENVIRONMENT DUE TO FAILURE OF HELMET TO PROTECT CREW AGAINST INHALATION OF SMOKE

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION OTHER
PRELAUNCH X LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP 00 LOSS OF, UNSAFE ENVIRONMENT RESP.ENGR. I.J.ALCNGI

31

RELATED FMEAS

JUNE

FMEA REQD YES NO

X

REFERENCES

SLM 21.0, RDD SD72-SH-01C7, MCR 2118, MCR 1591

HAZARD CAUSES

- 01-IMPROPER LOCATION OF HELMET - NOT IN READY REACH
- 02-EXCESSIVE DONNING TIME REQUIRED
- 03-STOWAGE PROVISIONS INADEQUATE-DOESNOT PERMIT QUICK RELEASE
- 04-CAPACITY INADEQUATE TO MEET MISSION REQUIREMENTS
- 05-EQUIPMENT COMPONENT FAILURE

HAZARD EFFECTS

EXCESSIVE INHALATION OF SMOKE COULD RESULT IN ILLNESS OR INCAPACITATION OF CREW AND POSSIBLE LOSS OF CREW AND VEHICLE. WORST CASE

HAZARD NUMBER LAXX-0777-3A

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD U.BROWN

DISPOSITION	RESP GRP	ACTION DOCUMENTATION
O1-VERIFY BY DESIGN, MOCKUP, AND TEST.	397-102	
O2-VERIFY BY DESIGN, MOCKUP AND TEST.	397-102	
O3-VERIFY BY DESIGN, MOCKUP AND TEST.	397-102	
O4-DESIGN CAPACITY PER TBD, VERIFY PER TEST TBD	397-102	
O5-DESIGN AND TEST PER TBD	397-102	

CLUSURE RATIONALE

THIS HAZARD HAS BEEN DELETED BECAUSE THE HELMET WITH
SMOKE MASK IS TO BE PROVIDED AS GFE. REF: MCR 2118 E 1591.
HAZARD ANALYSIS TO BE PREPARED BY NASA/JSC SAFETY

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT
NUMBER OR OPERATION INIT TRACK CAT STATUS DATE
LAXX-J117-4A SMOKE PROTECT HELMET CA 12 DELETED 050674

HAZARD DESCRIPTION

HELMET FAILS TO PROTECT EYES AGAINST SMOKE CAUSING LOSS OF VISIBILITY

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS OTHER
PRELAUNCH X LIFT OFF THRU ORBIT ON ORBIT
DE-ORBIT THRU LANDING

HAZARD GROUP DD LOSS OF, UNSAFE ENVIRONMENT RESP.ENGR. I.J.ALONGI

33 RELATED FMEAS
NONE

REFERENCES

SDM 21.0, RDO SD072-SH-01C7, MCR 2118 AND MCR 1591

HAZARD CAUSES

- 01- HELMET IMPROPERLY STORED OR INACCESSIBLE
- 02- CAPACITY INADEQUATE
- 03- HELMET COMPONENT FAILURE
- 04- HELMET EQUIPMENT NOT COMPATIBLE WITH EJECTION SEAT

HAZARD EFFECTS

INJURY OR POSSIBLE LOSS OF CREW AND VEHICLE DUE TO LOSS OF VISIBILITY
AND CONTROL OF VEHICLE DURING LANDING. WORST CASE.

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER LAXX-0717-4A

RELATED HAZARD ANALYSES

JUNE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

DISPOSITION

01-VERIFY BY DESIGN, MCKUP AND TEST

02-DESIGN CAPACITY PER T&D

03-DESIGN AND TEST PER T&D

04-VERIFY BY DESIGN, MCKUP AND TEST.

RESP GRP

ACTION DOCUMENTATION

397-102

34

CLOSURE RATIONALE

THIS HAZARD HAS BEEN DELETED BECAUSE THE HELMET WITH
SMOKE MASK IS TO BE PROVIDED AS GFE. REF: MCR 2118 & 1591.
HAZARD ANALYSIS TO BE PREPARED BY NASA/JSC SAFETY

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HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2C INIT TRACK	HAZARD STATUS	ENTRY DATE
LYXX-J711-06	EMERG BREATHING SYS	CA CA/CN 001	IN WORK	051276

HAZARD DESCRIPTION

IMPROPER/INACCESSIBLE LOCATION OF EMERGENCY BREATHING SYS, POS

FLIGHT TEST X GROUND TEST FERRY FLIGHTS CRBITAL MISSION X OTHER
PRELAUNCH X LIFT OFF THRU ORBIT X ON CRBIT X CE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP.ENGR. I.J.ALCNGI

35

RELATED FMEAS	FMEA	REQD	YES	NO
JUNE			X	

REFERENCES

SDM 21.0, RDU SD72-SH-01C7

HAZARD CAUSES

01-TOO REMOTELY LOCATED FRM WORK STACIONS TO PERMIT IN-PLACE
USAGE DURING LAUNCH, REENTRY AND CN-ORBIT EMERGENCIES
02-NOT READILY RETRIEVABLE FOR EMERGENCY PRE-GRND EGRESS, DONNING
03-MOUNTING/STORAGE LOCATIUNS INTERFERE WITH GROUND INGRESS/
EGRESS CR ON-ORBIT IVA

HAZARD EFFECTS

U1-INCAPACITATING ATMOSPHERE PREVENTING PERFORMANCE OF EMERGENCY
PROCEDURES WITH RESULTANT LOSS OF VEHICLE AND CREW

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HA-TRACK

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HAZARD NUMBER 1YXX-0711-C6

02-DELAYED EMERGENCY GROUND EGRESS RESULTING IN INJURY OR LOSS
OF CREWMAN
03-INTERFERENCE WITH NORMAL CRITICAL ACTIVITIES RESULTING IN
INJURY OR LOSS OF CREWMEN/VEHICLE

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD G.E.BAZELL

SAFETY LEAD R.E.RABY

36

DISPOSITION

RESP GRP ACTION DOCUMENTATION

397-102

O1-Locate to permit on-station usage without necessitating removal of unit from its

mounting

O2-Provide ready accessibility and quick release from on-station and stowage mounting

O3-Locate to minimize interference with crew movements

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HA-TRACK

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	HAZARD INIT TRACK	HAZARD STATUS	ENTRY DATE
IVXX-0121-1C	EJECTION PANEL	CA	CN/CN 1	CCNTROLLED 041674

HAZARD DESCRIPTION

FAILURE OF EMERGENCY EJECTION PANEL TO EJECT CLEAR OF VEHICLE.

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT CE-ORBIT THRU LANDING X

HAZARD GROUP AA ILL., INJURY, LOSS OF PERS. RESP. ENGR. I.J.ALONGI

37

RELATED FMEAS

01-2-4800002.00 - 8CCC3, 0 - 48000044

REFERENCES

VLI0-OC3349, SDM 21.0, RDD SD72-SH-0107, SD74-SH-0299

HAZARD CAUSES

- 01-INTERFACE-INTERFERENCE BETWEEN INNERPANEL AND CUTTER STRUCTURE
- 02-DUE TO CRASH INDUCED SHIFT OF CREW MODULE
- 03-ACTUATING CONTROL FAILURE- INTERNAL OR EXTERNAL.
- 04-INTERFACE-ENERGY TRANSFER AND SEQUENCE SYSTEM FAILURE.
- 05-INTERFACE-SEVERENCE ASSEMBLY FAILURE
- 06-INTERFACE-THRUSTER FAILS OR INADEQUATE.
- 07-HINGE GUIDE FAILURE

HAZARD EFFECTS

INJURY OR LOSS OF PERSONNEL AS A RESULT OF NOT PERMITTING EGRESS
OR INGRESS, OR SAFE EJECTION.

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER 1VXX-C721-1C

RELATED HAZARD ANALYSES

J4- 1VXX-0207-C9; 05- 1VXX-C207-07; 06- 1VXX-0207-10
01- 1VXX-0101-04

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

DISPOSITION

03- AND C7-TU BE VERIFIED BY TEST 397-102

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON REQUIREMENTS CONTAINED IN CERTIFICATION
PLAN SD74-SH-0041-1 AND SUCCESSFUL COMPLETION OF SCHEDULED SLED
TEST PER TEST PLAN SD74-SH-0299

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE
G.E.BAZELL 397-102 061275 F.J.ATTAWAY 061275

SD77-SII-0001-08

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT OR OPERATION NUMBER	LEVEL	H2D INIT TRACK	HAZARD CAT STATUS	ENTRY DATE
IVXX-0721-2A	EJECT PANEL	CA CA	13 RESIDUAL	041774

HAZARD DESCRIPTION

EJECTED PANEL STRIKING GROUND PERSONNEL AND/OR PROPERTY

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSIION X OTHER
PROLAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X
HAZARD GROUP AA INJURY. LOSS OF PERSONNEL RESP.ENGR. I.J.ALONGI

FMEA REQD YES NO

39 NONE X

RELATED FMEAS

REFERENCES

VL10-0C3349, SDM 21.0, RDD SD72-SH-0107

HAZARD CAUSES

01-IMPACT ZONE UNKNOWN DURING GROUND EJECTION
02-GROUND RESCUE PERSONNEL IN EJECTION PATH OF PANEL
03-INADVERTENT OR PREMATURE EJECTION DUE TO CRASH IMPACT
04-FLIGHT EJECTION OVER POPULATED AREA
05-INADVERTENT OR PREMATURE EJECTION BY PERSONNEL

HAZARD EFFECTS

INJURY, LOSS OF PERSONNEL, OR DAMAGE TO PROPERTY. WORST CASE.

RELATED HAZARD ANALYSES

NONE

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HA-TRACK

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HAZARD NUMBER 1VXX-C721-2A

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

RESP GRP ACTION DOCUMENTATION

U1-NJ CONTROL OF VEH POSITION DURING EMERGENCY- RESIDUAL HAZARD

U2-DESIGN AND LOCATE EJECTION CONTROLS PER TBD.

03-SAME AS U1.

04-NJ CONTROL OVER EMERGENCY - RES

05-DESIGN AND LOCATE CONTROLS PER TBD AND VERIFY BY MOCKUP.

40

CLOSURE RATIONALE

THIS HAZARD REMAINS RESIDUAL DUE TO THE UNPREDICTABILITY OF EJECTION OCCURRENCE AND ITS CONSEQUENCES. HOWEVER, IT IS CONSIDERED AN ACCEPTABLE RISK IN VIEW OF FLIGHT PLANNING EFFORTS TO AVOID FLIGHT PATH PROGRAMMING WITHIN PROXIMITY OF POPULATED AREAS AND GROUND RESCUE PROCEDURAL CAUTIONS WITH RESPECT TO EJECTED PANEL CONTACTS.

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
G.E.BAZELL	060975	F.J.ATTAWAY	060975

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HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT
NUMBER

OR OPERATION

IVAX-0721-3B EJECTION SEATS

LEVEL HZD HAZARD ENTRY
INIT TRACK CAT STATUS DATE

CA CN/CN 1 CONTROLLED 041774

HAZARD DESCRIPTION

EJECTION SEAT FAILURE TO EJECT OR IMPROPER OPERATIONS

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X
HAZARD GROUP AA ILL., INJURY, LOSS OF PERS. RESP.ENGR. I.J.ALONGI

RELATED FMEAS

41

JF-2-25001, 25002, 25006, 25008, 25009, 25010, 25011,
25012, 25013, 25014, 25017, 25018, 25023, 25025, 25027,
25028, 25029, 25030, 25033, 25034, 25040

REFERENCES

VL70-003349, LOCKHEED SP-4086 AND SP-4094, SDM 21.0
RDU SD72-SH-01C7

HAZARD CAUSES

SD77-SII-0001-08

- 03-SEAT STRUCTURAL FAILURE
- 04-SEAT RETRACTOR FAILURE
- 05-SEAT CATAULPT ROCKET FAILURE
- 06-DROGUE CHUTE FAILS TO DEPLOY
- 07-SEAT FAILS TO SEPARATE FROM PERSONNEL
- 08-MAIN CHUTE FAILS TO DEPLOY
- 09-DROGUE CHUTE FAILS TO SEPARATE
- 10-EMERGENCY O2 FAILURE
- 12-SEAT GUIDANCE FAILURE

HA-TRACK

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HAZARD NUMBER 1VXX-C721-3B

13-INTERFACE- SEAT RAIL MISALIGNMENT.
14-INTERFACE- FAULTY ENERGY TRANSFER AND SEQUENCING SYS
15-INTERFACE-SUPPORTING STRUCTURAL FAILURE

HAZARD EFFECTS

ILLNESS, INJURY, LOSS OF PERSONNEL, LCSS OF ORBITER, AND/OR LOSS
OF PROPERTY DUE TO ONE OF THE ABOVE CAUSES. WORST CASE

RELATED HAZARD ANALYSES

13- 1VXX-C102-C2; 14- 1VXX-C207-09; 15- 1VXX-0102-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

RESP GRP ACTION DOCUMENTATION

03-VERIFY PER SLED TEST PROGRAM	397-102
04-SAME AS 03.	397-102
05-SAME AS 03.	397-102
06-SAME AS 03.	397-102
07-SAME AS 03.	397-102
08-SAME AS 03.	397-102
09-SAME AS 03.	397-102
10-SAME AS 03.	397-102
12-SAME AS 03.	397-102

HA-TRACK

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HAZARD NUMBER 1VXX-0721-3B

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON REQUIREMENTS CONTAINED IN CERTIFICATION
PLAN SD74-SH-0041-1 AND IMPLEMENTATION OF CORRECTIVE ACTION
NOTED ABOVE

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
G.E.BAZELL	397-102	061075	F.J.ATTAWAY	061075

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT
NUMBER OR OPERATION

1YXX-0121-4B EJECTION SEAT

LEVEL INIT TRACK CAT

CA CN/CN 123 CONTROLLED 041774

HAZARD DESCRIPTION

PREMATURE OPERATION OF EJECTION SEAT

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP AA ILL., INJ., LOSS OF PERS. RESP.ENGR. I.J.ALDONI

RELATED FMEAS

44
NONE

REFERENCES

VL70-003349, LOCKHEED SP-4036 AND SP-4094
SDM 21.0, RDD SD72-SH-0107

HAZARD CAUSES

02-ACCIDENTAL ACTIVATION OF-D-RING BY PERSONNEL.
03-INTERFACE-IMPROPER SEQUENCE OF ENERGY TRANSFER AND SEQ-
UENCING SYSTEM.

HAZARD EFFECTS

LOSS OF PERSONNEL DUE TO PREMATURE EJECTION OF SEAT IN SPACE

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER 1VXX-0721-4B

RELATED HAZARD ANALYSES

U3-1VXX-0207-C9

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

U3-PROVIDE SAFETY DEVICE

RESP GRP ACTION DOCUMENTATION

397-102 V070-660350 ESCAPE

SYSTEM SAFETY

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON PROVISION OF CN-ORBIT SAFETY PINS TO
PRECLUDE INADVERTENT ACTIVATION OF EJECTION SYSTEM IN ORBIT

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

G.E.BAZELL 397-102 061075 F.J.ATTAWAY 061375

SD77-SII-0001-08

HAZARD

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2D INIT TRACK	HAZARD CAT STATUS	ENTRY DATE
IVXA-0121-5A	EJECTION SEAT	CA CN/CN 1	CONTROLLED	041774

HAZARD DESCRIPTION

IN FLIGHT COLLISION OF SEATS DURING EJECTION.

FLIGHT TEST X GROUND TEST PRELAUNCH	FERRY FLIGHTS LIFT OFF THRU ORBIT X	ORBITAL MISSION X DE-ORBIT THRU LANDING X
HAZARD GROUP BB COLLISION. IMPACT		RESP.ENGR. I.J.ALONGI

RELATED FMEAS

46

JUNE

REFERENCES

VL70-003349, LOCKHEED SP-4086 AND SP-4094
SDM 21.0, RRD SD72-SH-0107, MCR 1214

HAZARD CAUSES

01-EJECTION OF SEATS DURING ROLL OR YAW OF VEHICLE
02-INTERFACE-ENERGY TRANSFER AND SEQUENCE SYS FAILURE.
03-INTERFACE- MISALIGNMENT OF RAILS.
04-MISALIGNED ROCKET CATAPOULT - DESIGN
05-INTERFACE-ROCKET CATAPOULT FAILURE
06-INDUCED SEAT AERO DRAG DUE TO SEAT PROJECTIONS OR FLAILING
LEGS AND ARMS

HAZARD EFFECTS

INJURY OR LOSS OF PERSONNEL DUE TO COLLISION OF SEATS

SD77-SII-0001-08

HAZARD NUMBER 1VXX-C721-5A

RELATED HAZARD ANALYSES

J2- 1VXX-0207-09; 03- 1VXX-C102-02; 05- 1VXX-0207-10

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD O.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

VERIFY PER SLED TESTS

RESP GRP ACTION DOCUMENTATION

397-102	IL ASCD/FSA-75-064 COLLISION AVOIDANCE STUDY. TSR MINUTES 2438MA, 27 MAY 1975
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CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON IMPLEMENTATION OF AVOIDANCE STUDY RECOMMENDATIONS AS APPROVED BY TSR. THESE RECOMMENDATIONS CONSIST OF A 0.5-SECOND TIME DELAY BETWEEN SEAT EJECTIONS AND FORESHORTENING INBOARD RAILS TO PROVIDE A DIVERGENCE BETWEEN SEAT EJECTION PATHS

HAZARD DISPOSITION CONCURRENCE

G.E.BAZELL	FUNCTIONAL SUPERVISION DEP-GRP	DATE 061075	SAFETY SUPERVISION F.J.ATTAWAY	CATE 061075
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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2D INIT TRACK	HAZARD STATUS	ENTRY DATE
IVAX-0721-6B	EJECTION SEAT RAILS	CA	CN/CN 1	CONTROLLED 041974

HAZARD DESCRIPTION

FAILURE OF EJECTION RAILS TO PROPERLY GUIDE SEAT DURING EJECTION

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PRELAUNCH LIFT OFF THRU ORBIT X CN ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP BB COLLISION, IMPACT RESP.ENGR. I.J.ALONGI

RELATED FMEAS

48

NONE

FMEA REQD YES NO

X

REFERENCES

SDM 21.0, RDD SD72-SH-0107, SD74-SH-0299

HAZARD CAUSES

O1-RAIL STRUCTURAL FAILURE.
O2-ATTACH FITTING FAILURE.
O3-INTERFACE- SUPPORTING CREW MODULE STRUCT FAIL OR DEFORMATION.

HAZARD EFFECTS

D77 - SII - 0001 - 08
DEFURMED, MISALIGNED, AND/OR FRACTURED RAILS WOULD RESULT IN EJECTING PERSONNEL INJURY OR LOSS AS A RESULT OF 1. STRIKING EJECTION PANEL STRUCTURE 2. STRIKING SIDE, FORWARD, OR REAR FLIGHT DECK AREA 3. RETARD OR STOP EJECTION 4. CAUSE ROCKET EXHAUST IMPINGEMENT ON CREW. WORST CASE.

RELATED HAZARD ANALYSES

03- LVXX-0102-02

HA-TRACK

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HAZARD NUMBER 1VXX-0721-6B

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

VERIFY PER SLED TEST

RESP GRP ACTION DOCUMENTATION

397-102 SD74-SH-0299

SLED TEST PLAN

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON REQUIREMENTS CONTAINED IN CERTIFICATION
PLAN SD74-SH-0041-1 AND IMPLEMENTATION OF CORRECTIVE ACTION
NOTED ABOVE

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE
G.E.BAZELL 397-102 061075 F.J.ATTAWAY 061075

HA-TRACK

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	HZD INIT TRACK	HAZARD STATUS CAT	ENTRY DATE
IVAX-U721-7A	EJECTION SEAT RAILS	CA	CN/CN 1	CONTROLLED 041974

HAZARD DESCRIPTION

EJECTION SEAT RAILS FAIL TO SECURE SEAT DURING CRASH LOADS

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS
 PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT

HAZARD GROUP BB COLLISION, IMPACT

RESP.ENGR. I.J.ALONGI

RELATED FMEAS

07-25030-1

FMEA REQD YES NO

X

REFERENCES

MCR-156, SDM 21.0, ROD SD72-SH-0107

HAZARD CAUSES

- 01-RAIL STRUCTURAL FAILURE.
- 02-ATTACH FITTING FAILURE.
- 03-INTERFACE-CREW MODULE SUPPORT STRUCT. FAILURE OR DEFORMATION.

HAZARD EFFECTS

- INJURY OR LOSS OF PERSONNEL AS A RESULT OF SEAT TEARING LOOSE DURING CRASH CONDITIONS, WORST CASE.

RELATED HAZARD ANALYSES

03- IVXX-0102-02

HA-TRACK

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HAZARD NUMBER 1VXX-0721-7A

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-DESIGN AND VERIFY PER STATIC TEST
397-102

02-SAME AS 01.

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON REQUIREMENTS CONTAINED IN CERTIFICATION PLAN SD74-SH-0C41-1 AND IMPLEMENTATION OF CORRECTIVE ACTION NOTED ABOVE

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE
G.E.BAZELL 397-102 061275 F.J.ATTAWAY 061275

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	HZD INIT	HAZARD TRACK CAT STATUS	ENTRY DATE
IVXX-J721-8A	GROUND EMERG EGRESS	CA	CN/CN 1	CONTROLLED 091874

HAZARD DESCRIPTION

INTERNAL AND EXTERNAL EJECTION PANEL CONTROLS ARE INACCESSIBLE FOR ACTUATION IN RESPONSE TO IMMEDIATE EMERGENCY GROUND EGRESS NEEDS

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION X OTHER PRELAUNCH LIFT OFF THRU ORBIT CN ORBIT DE-ORBIT THRU LANDING X
HAZARD GROUP AA INJURY/LOSS OF PERSONNEL RESP. ENGR. I.J. ALONGI

52

RELATED FMEAS

NONE

FMEA REQD	YES	NO
X		

REFERENCES

MCR 1057, SDM 21.0, RDD SD72-SH-0107

HAZARD CAUSES

01-INTERIOR CONTROL IS BEYOND THE REACH OF SMALL PERCENTILE RESTRAINED PRESSURE SUITED CREWMAN
02-EXCESSIVE FORCE REQUIRED TO ACTUATE INTERNAL CONTROL FROM A SEATED POSITION
03-INTERFACE-CRASH INDUCED STRUCTURAL DISTORTION JAMS ACCESS DOOR TO EXTERNAL FUSELAGE MOUNTED CONTROL MAKING IT INACCESSIBLE FOR USE

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HA-TRACK

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HAZARD NUMBER IVXX-0721-8A

HAZARD EFFECTS

EGRESS DELAY OR ENTRAPMENT FOLLOWING A CRASH CAN RESULT IN LOSS OF PERSONNEL THRU ENSUING FIRE, EXPLOSIVEN, TOXIC ATMOSPHERE OR DELAYED MEDICAL AID TO INJURED CREWMAN

RELATED HAZARD ANALYSES

U3-1ZXX-0101-C4

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

U1-THE CONTROL CAN BE REACHED BY ANY SIZED CREWMAN BY RELEASING HIS SHOULDER STRAP RESTRAINTS FIRST IF NECESSARY
U2-TO BE DETERMINED BY TEST AND CORRECTED AS NECESSARY

RESP GRP ACTION DOCUMENTATION

397-102 01 AND 02 - IL NOS.
394-400-74-168 AND
CR-397-101-74-050

CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON THE RESULTS CF MOCKUP AND TESTS PER REFERENCED IL NOS. 394-400-74-168 AND CR-397-101-74-050

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE
G.E.BAZELL 397-102 061275 F.J. ATTAWAY 061275

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HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	OK OPERATION	LEVEL	H2D INIT	HAZARD STATUS	ENTRY DATE
IVAX-0721-9C	GROUND EMERG EGRESS	CA	CN/CN 1	CONTROLLED	072674

HAZARD DESCRIPTION

INABILITY TO SAFELY AND EXPEDITIOUSLY PERMIT EMERGENCY EGRESS OF CREW WITHIN 60 SECONDS AFTER LANDING

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION X OTHER PRÉLAUNCH X LIFT OFF THRU ORBIT CN ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP AA LOSS OF PERSONNEL

FMEA "REQD YES NO

54 RELATED FMEAS
J7-2 400,000 X

REFERENCES

MCR J960, CEI MJC70-0001, CER 74035, MCR 1552

HAZARD CAUSES

01-EGRESS OPENING TOO SMALL TO PERMIT PASSAGE OF PERSONNEL EITHER IN SHIRT SLEEVES OR WEARING BREATHING EQUIPMENT AND/OR ENCUMBERED BY OTHER FIRST AID DEVICES NECESSITATED BY PHYSICAL INJURIES

02-EGRESS OPENING TO SMALL TO PERMIT PROPER BODY ORIENTATION AND STABILIZATION FOR SAFE SECUREMENT OF EGRESS LOWERING DEVICE AND SAFE INITIAL BODY ATTITUDE AT BEGINNING OF DESCENT

03-INADEQUATE HANDHOLDS, SUPPORTS AND OTHER AIDS REQUIRED FOR GAINING ACCESS TO EGRESS OPENING
04-INADEQUATE LADDER AND/OR PASSAGE PROVISIONS BETWEEN FLIGHT AND MID-DECK IMPEDING MOBILITY TO ACTIVE EGRESS PORT

D77-SII-0001-08

HA-TRACK

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HAZARD NUMBER 1VXX-0721-SC

- 05-INNER CABIN PROTRUSIONS IN THE VICINITY OF EGRESS OPENING RE-TARUS EGRESS BY SNAGGING CLOTHING OR EQUIP OF EGRESSOR
- 06-CREWMAN UNABLE TO MAINTAIN SAFE GRASP OF LOWERING DEVICE DURING DESCENT
- 07-INTERFACE-EGRESS DEVICE FAILS

HAZARD EFFECTS

- DELAY IN ACCOMPLISHING AN EMERGENCY EGRESS CAN RESULT IN LOSS OF PERSONNEL FROM SUCH POTENTIAL HAZARDS AS FIRE, EXPLOSION CR TOXICITY

RELATED HAZARD ANALYSES

5/1-1ZXX-C710-01

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

RESP GRP ACTION DOCUMENTATION

- 01 THRU 06 TO BE VERIFIED BY TESTS AS NOTED
- 397-102 TR S-125009 HORIZ. GROUND EGRESS
- TR S-125010 VERT. GROUND EGRESS

HAZ-TRACK

01/27/77 PAGE 3

HAZARD NUMBER 1VXX-0721-SC

CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON THE RESULTS OF GROUND EGRESS TESTS AND EVALUATION PER REFERENCED TR'S: S-125009 AND S-125010

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION	DEP-GRP	DATE	SAFETY SUPERVISION	DATE
G.E.BAZELL	C61275	397-102	F.J.ATTAWAY	061275

HA-TRACK

01/27/77 PAGE 1

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	HLD INIT TRACK	HAZD STATUS	ENTRY DATE
IVAX-J721-10A	EJECTION SEAT	CA	CN/CN 1	CCNTROLLED 061174

HAZARD DESCRIPTION

SEAT CATAULPT CAN BE FIRED BY PULLING T-HANDLE RESULTING IN IMPACTING OF CREWMAN WITH EJECTION PANELS IF PANELS HAVE NOT BEEN SEVERED PREVIOUSLY AND JETTISONED

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP BB COLLISION/IMPACT

RESP.ENGR. I.J.ALONGI

FMEA	REQD	YES	NO
-----	-----	-----	X

RELATED FMEAS

NONE

REFERENCES

F-12 EJECTION SEAT MODIFICATION. SDM 21.0, PAGE 80
RUD SD72-SH-01C7

HAZARD CAUSES

01-INTERFACE-ENERGY TRANSFER AND SEQUENCE SYS FAILURE
02-T-HANDLE ACTUATED PRIOR TO PANEL SEVERENCE AND JETTISON

HAZARD EFFECTS

LOSS OF PERSONNEL AS A RESULT OF IMPACT WITH NON-EJECTED PANELS.
THE BACK-UP T-HANDLE MODE OF OPERATION WAS INTENDED TO BE USED
ONLY ON VEHICLES WHERE HATCH JETTISON COULD BE POSITIVELY
ASSURED PRIOR TO T-HANDLE INITIATION TO PREVENT FIRING INTO NON-
YIELDING HATCH OR CANOPY.

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER 1VXX-0721-10A

RELATED HAZARD ANALYSES

J1- 1VXX-0207-C9

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

SAFETY LEAD R.E.RABY

DISPOSITION

RESP GRP ACTION DOCUMENTATION

02-MINIMIZE HAZARD BY PROVIDING
A POSITIVE INTERLOCK TO PRE-
VENT ACTUATION OF T-HANDLE
PRIOR TO INITIATION OF NORMAL
EJECTION SEQUENCE

397-102 LOCKHEED DWG RI-1487

D-RING INSTL,
STABILIZED EJECTION
SEAT

CLOSURE RATIONALE

THIS HAZARD IS CLOSED ON THE BASIS THAT THE T-HANDLE IS PROVIDED
WITH AN EJECTION SYSTEM INITIATION INTERLOCK - SEE DWG RI-1487 -
AND SERVES AS A BACKUP FOR ROCKET/CATAPULT FIRING IN THE EVENT OF
A SEQUENCING SYSTEM MALFUNCTION.

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE
G.E.BAZELL 397-102 061375 F.J.ATTAWAY 061375

SD77-SH-0001-08

HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
JVXX-0121-11	EJECTION SEAT	CA	CN/CN 1	CONTROLLED 100874

HAZARD DESCRIPTION

PREMATURE ANEROID ACTUATION OF INITIATORS RESULTING IN HAZARDOUS CHUTE DEPLOYMENT AT ALTITUDES ABOVE 15,000 FEET

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP AA LOSS OF PERSONNEL

RESP. ENGR I.J. ALONGI

RELATED FMEAS	FMEA REQD	YES	NO
59			X
07-2-25015			X

REFERENCES

SOM 21.0, RDD SD72-SH-0107, MCR 1214

HAZARD CAUSES

01-INITIALLY, PRIOR TO EJECTION SECQUENCING, THE ANEROIDS ARE SENSING A ZERO-ALTITUDE CABIN PRESSURE AND THEREFORE PROVIDING A FALSE ALTITUDE REFERENCE. IF, DURING EJECTION, THE ANEROID RESPONSE TO ACTUAL ALTITUDE PRESSURE CHANGE LAGS THE INITIATOR DELAY PROVISIONS, A PREMATURE CHUTE DEPLOYMENT WILL OCCUR DURING EJECTIONS ABOVE 15,000 FEET

HAZARD EFFECTS

HIGH OPENING SHOCK LOADS CAN CAUSE EXTENSIVE DAMAGE TO MAIN CANOPY AND/OR INJURY TO CREWMAN WITH THE END RESULT IN A LOSS OF CREWMAN

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER 1VXX-0721-11

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

DISPOSITION

6

U1-THE ADEQUACY OF THE ANEROID
PRESSURE RESPONSE TBD BY ENGRG
TEST AND EVALUATION

SAFETY LEAD R.E.RABY

RESP GRP	ACTION DOCUMENTATION
397-102	MCR 1214 AUTHORIZED EVALUATION OF ANEROID RESPONSE TO ABOVE 15K FEET EXEC- TICNS ALTITUDES

CLOSURE RATIONALE

SPECIAL TEST OF SU4-10024-530 ANEROID ACTUATED INITIATOR WAS
PERFORMED BY UNIVERSAL PROPULSION CO., DOCUMENT NO. 1543, DEC 3,
1974. THE PRECEDING TESTS CONCLUDES THE ANEROID INITIATOR WILL
SENSE THE AMBIENT ALTITUDE AND PROPERLY BLOCK BALLISTIC INITI-
ATIONS ABOVE 15K FT. ALTITUDES. BLOCKAGE IS ACHIEVED IN LESS
THAN 90 MILLISECONDS AND THE BALLISTIC INITIATION TIME DELAY OF
1.40 SECONDS IN THE SEAT CIRCUIT WILL PROVIDE A SUBSTANTIAL
MARGIN OF SAFETY OF NOMINALLY 1.31 SECCONDS.

HAZARD DISPOSITION CONCLARENCE

FUNCTIONAL SUPERVISION DEP-GRP	DATE	SAFETY SUPERVISION	DATE
G.BAZELL 397-102	031875	F.J.ATTAWAY	031875

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HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT LEVEL HAZARD ENTRY
NUMBER OR OPERATION INIT TRACK CAT STATUS DATE
LYXX-0721-12C EJEC SEAT BACK WEDGE CA CN/CN 1 CONTROLLED 110474

HAZARD DESCRIPTION

FAILURE OF EJECTION SEAT BACK ANGLE DEVICE TO RETRACT TO
PROVIDE NORMAL SEAT ANGLE REQUIRED FOR SAFE EJECTION OR NORMAL
REACH/VISION POSITION FOR LANDINGS

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER
PKELAUNCH LIFT OFF THRU ORBIT X GN ORBIT CE-ORBIT THRU LANDING X

HAZARD GROUP AA INJURY/LCSS OF PERSONNEL RESP ENGR I.J. ALONGI

FMEA REQD YES NO
RELATED FMEAS

07-2-25C32 X

REFERENCES

MCR 1313, MCR 3545, MLO3C8-0053

HAZARD CAUSES

01-ACCELERATION AND VIBRATION INDUCED RETRACTION SYS FAILURE
02-FAILURE OF THE RETRACTION SYSTEM TO INTEGRATE WITH THE EJECT.
SYSTEM SEQUENCING THEREBY INTERFERING WITH INERTIAL REEL RETRACTION
FOR PROPER PRE-EJECTION BDY POSITIONING

SD77-SII-0001-08

HAZARD NUMBER 1YXX-0721-12C

HAZARD EFFECTS

IMPROPER BODY POSITION COULD RESULT IN PHYSICAL INJURIES FROM
CATAPULT ACCELERATION FORCES DURING EJECTION.
IMPROPER BODY POSITION MAY ADVERSELY AFFECT VISIBILITY THROUGH
WINDSHIELD AND REACH AND VISION FOR CONTROLS AND DISPLAYS DURING
ABORT AND LANDINGS

RELATED HAZARD ANALYSES

62

HAZARD IDENTIFICATION CONCURRENCE
FUNCTIONAL LEAD D.BROWN

62

DISPOSITION
01-FUNCTIONAL TESTING SHOULD BE
PERFORMED TO CERTIFY FOR OV-
102 USAGE
02-FUNCTIONAL TESTING WILL BE
PERFORMED TO VERIFY COMPATI-
BILITY OF INTEGRATED SYSTEMS

SAFETY LEAD R.E.RABY
RESP GRP ACTION DOCUMENTATION
397-102 ML0308-0053
397-102
G.E.BAZELL 397-102 061775 F.J.ATTAWAY 061775

CLOSURE RATIONALE

SD 77 - SH - 0001 - 08

HAZARD IS CLOSED BASED ON IMPLEMENTATION OF CORRECTIVE ACTION
NOTEJ ABOVE. MCR 3545 DIRECTS ADDITION OF BACK DEVICE VERIFI-
CATION CHECKOUT TO SLED TEST ML0308-0053

HAZARD

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OF OPERATION	H2D INIT TRACK	HAZARD CAT STATUS	ENTRY DATE
IYXX-0721-13	HIGH ALTITUDE EJECT	CA CA/CN 1	IN-WORK	081375

HAZARD DESCRIPTION

HIGH ALTITUDE EJECTIONS ENTAIL RAPID CABIN DECOMPRESSION WHICH COULD CREATE FLYING PROJECTILES FROM LOOSE OR STOWED OBJECTS DUE TO RESULTANT AIR FLOW EFFECTS

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER PKELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-CRBIT THRU LANDING X

HAZARD GROUP BB COLLISION/IMPACT RESP ENGR I.J.ALONGI

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

SDM 21.0, RDD SD72-SH-01C7, MCR 1964

HAZARD CAUSES

O1-N0 SPECIFIC PROVISIONS HAVE BEEN MADE TO COUNTERACT ANY MASS AIRFLOW EFFECTS RESULTING FROM WORST CASE RAPID DECOMPRESSIONS

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HAZ-TRACK

01/27/77 PAGE 2

HAZARD NUMBER 1VXX-0721-13

HAZARD EFFECTS

CONTACT FROM FLYING OBJECTS MAY CAUSE DIRECT PHYSICAL INJURY TO CREWMEN OR MAY DISABLE THE ESCAPE SYSTEM TO THE EXTENT OF PREVENTING A SUCCESSFUL EJECTION

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE	FUNCTIONAL LEAD	RESP GRP	SAFETY LEAD	ACTION DOCUMENTATION
64	O.B.MORRIS		R.E.RABY	
DISPOSITION				CONDUCT STUDIES TO PROVIDE AIR FLOW DATA FOR ANALYZING THE POTENTIAL AND HAZARDOUS MOTIONS OF ITEMS WITHIN THE CREW COMPARTMENT. BASED ON THE PRECEDING ANALYSIS, A FINAL SAFETY EVALUATION WILL BE PERFORMED TO DETERMINE THE NEED FOR CORRECTIVE ACTION (REF:MCR 1564)

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HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT NUMBER	LEVEL OR OPERATION	H2D INIT TRACK CAT	HAZARD STATUS	ENTRY DATE
IVAX-U721-14	EJECTION SEAT	CA CA/CN 1	IN-WORK	011576

HAZARD DESCRIPTION

DURING PRELAUNCH CABIN PRESSURE TESTS, THE ANEROIDS CONTROLLING SEAT/MAN SEPARATION AND CHUTE DEPLOYMENT WILL BE SUBJECTED TO POSITIVE PRESSURES FOR WHICH THEY ARE NOT CERTIFIED AND MAY BE DAMAGED OR THROWN OUT OF CALIBRATION

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS
PRELAUNCH X LIFT OFF THRU ORBIT X CN ORBIT

ORBITAL MISSION X OTHER
DE-ORBIT THRU LANDING X

HAZARD GROUP AA LOSS OF PERSONNEL

RESP.ENGR. I.J.ALONGI

RELATED FMEAS

J7-2-25015

FMEA REQD YES NO

X

REFERENCES

SOM 21.0, RDD SD72-SH-0107, MCR 1983 REV 2, MCR 2838 REV 1

HAZARD CAUSES

01-2 PSIG CLOSEOUT PRESSURE TEST ON PAD PRIOR TO LAUNCH
02-3.2 PSIG PRESSURE TEST FOLLOWING MINOR DISTURBANCE TO CREW
MODULE PRESSURE VESSEL
03-15.0 PSIG PRESSURE TEST FOLLOWING MAJOR DISTURBANCE TO CREW
MODULE PRESSURE VESSEL

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HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER 1VXX-0721-14

HAZARD EFFECTS

DAMAGE TO ANEROIDS CAN RESULT IN PREMATURE CHUTE DEPLOYMENT AT HIGH ALTITUDE/VELOCITY, DELAYED OPENINGS OR NO OPENING AT ALL. ANY OF THE PRECEDING CONDITIONS CAN BE FATAL.

RELATED HAZARD ANALYSIS

HAZARD IDENTIFICATION CONCURRENCE

66

DISPOSITION

RESP GRP ACTION DOCUMENTATION

THE ANEROIDS SHOULD BE TESTED TO 397-102 DETERMINE THEIR CAPABILITY TO MEET SPACE SHUTTLE REQUIREMENTS AND SUBSEQUENTLY CERTIFIED PRIOR TO FLIGHT TEST

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HA-TRACK

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HAZARD ANALYSIS SUBSYSTEM/EQUIPMENT
NUMBER OR OPERATION INIT TRACK CAT STATUS ENTRY DATE

IVXX-0722-1A ESCAPE SYS GRND SAFE CA CN/CN 13 CONTROLLED 072374

HAZARD DESCRIPTION

ACCIDENTAL ACTUATION OF ESCAPE SYSTEM EJECTION SEATS OR ESCAPE PANELS DURING GROUND OPERATIONS.

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION X OTHER PRELAUNCH X LIFT OFF THRU ORBIT ON ORBIT OF-ORBIT THRU LANDING

HAZARD GROUP AA LOSS OF PERSONNEL

RESP.ENGR. I.J.ALCNGI

RELATED FMEAS

NONE

REFERENCES

SD 72-SH-0107

HAZARD CAUSES

O1-ESCAPE PANEL OR EJECTION SEAT ACTUATION HANDLES ARE PULLED BY PERSONNEL PERFORMING MAINTENANCE, INSPECTION OR SERVICING CN OR IN THE IMMEDIATE AREA OF THE SEATS AND RELATED ESCAPE CONTROLS

O2-FLIGHT CREW INADVERTENTLY PULLS CN HANDLES WHILE TRYING TO POSITION THEMSEVES INTO THE EJECTION SEATS DURING PRELAUNCH HAZARD EFFECTS

UNPLANNED ESCAPE PANEL JETTISON WILL CAUSE UNJUSTIFIABLE DAMAGE TO ORBITER AND POSSIBLE INJURY TO UNSUSPECTING PERSONNEL ON THE GROUND FROM IMPACT BY PANELS. SEAT EJECTION WOULD ENHANCE THE EFFECTS TO INCLUDE LOSS OF PERSONNEL SITTING UNSECURED IN THE SEATS OR IN THE PATHWAY OF THE INITIAL SEAT EXCURSION.

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HA-TRACK

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HAZARD NUMBER 1VXX-C722-1A

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.BROWN

DISPOSITION

68

RESP GRP ACTION DOCUMENTATION

- G1-PROVIDE SAFETY PINS OR SIMILAR DEVICES WITH ATTACHED STREAMERS THAT WILL SERVE AS POSITION LOCKS TO PREVENT INACCIDENT ACTUATION OF MANUALLY ACTUATED INITIATION CONTROLS
G2-SAME AS G1 ABOVE

397-102 SAME AS ABOVE

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON NOTED CORRECTIVE ACTION COMPLIANCE. THIS CONSISTS OF FLIGHT STATUS SAFETY PINS W/ATTACHED STREAMERS AND ARE SUPPLIED AS PART OF BASIC SEAT ASSEMBLY PER LOCKHEED DWG RI 3001-1

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE

SD77-SII-0001-08